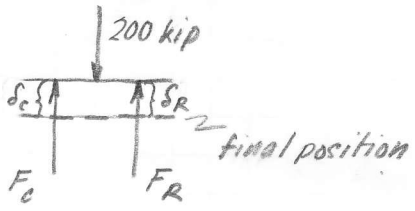
4-31



equilibrium: $\sum F_y = 0$, $F_c + F_R - 200\,kip = 0$

$F_c + F_R = 200\,kip$

compatibility: $\delta_c = \delta_R$

$$\frac{F_c L}{A_c E_c} = \frac{F_R L}{A_R E_R}$$

$$F_c = \frac{A_c E_c}{A_R E_R} F_R$$

$$F_c = \frac{\left(\frac{\pi}{4}(4\,in)^2 - (8)\frac{\pi}{4}(1\,in)^2\right)\left(4{,}200\,\frac{kip}{in^2}\right)}{(8)\frac{\pi}{4}(1\,in)^2\left(29{,}000\,\frac{kip}{in^2}\right)} F_R$$

$F_c = 1.0138\,F_R$

subst. into equilibrium equ: $1.0138\,F_R + F_R = 200\,kip$

$F_R = 99.315\,kip$

$F_c = 100.685\,kip$

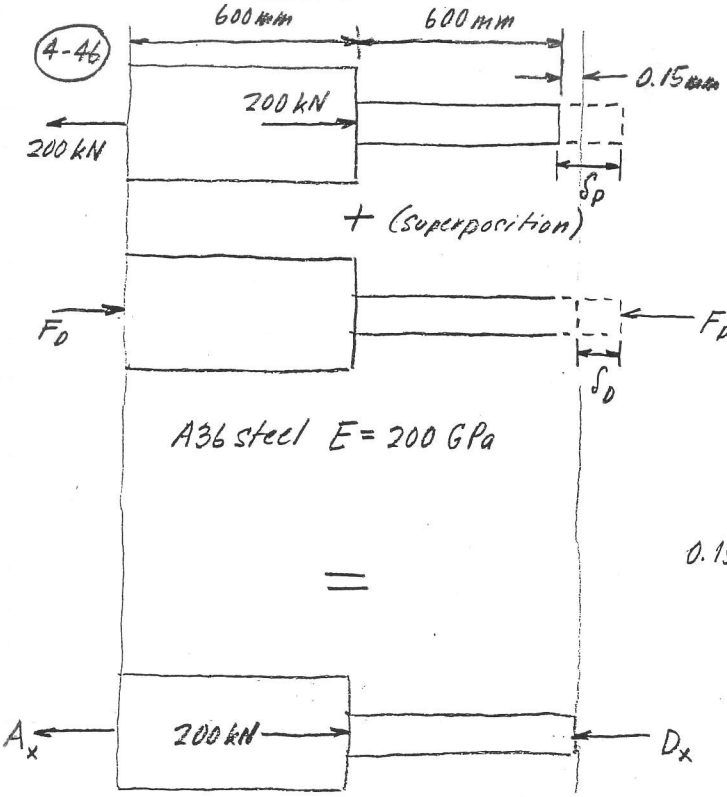
$$\sigma_c = \frac{100.685\,kip}{\pi(4\,in)^2 - (8)\frac{\pi}{4}(1\,in)^2} = 2.289\,ksi \rightarrow \boxed{2.29\,ksi}$$

(σ_y = n/a)

$$\sigma_s = \frac{99.315\,kip}{(8)\frac{\pi}{4}(1\,in)^2} = 15.81\,ksi \rightarrow \boxed{15.8\,ksi}$$

($\sigma_y = 50\,ksi$)

4-46



$\delta_p - \delta_D = 0.15\,mm$

$$\delta_p = \frac{PL}{AE} = \frac{(200\,kN)(600\,mm)}{\pi\left(\frac{50\,mm}{2}\right)^2\left(200{,}000{,}000\,\frac{kN}{m^2}\right)\left(\frac{1\,m}{1{,}000\,mm}\right)^2}$$

$\delta_p = 0.30558\,mm$ (> 0.15 mm contacts wall)

$\delta_D = 0.30558\,mm - 0.15\,mm = 0.15558\,mm$

$$\delta_D = 0.15558\,mm = \frac{F_D(600\,mm)}{\pi\left(\frac{50\,mm}{2}\right)^2\left(200\,\frac{kN}{mm^2}\right)} + \frac{F_D(600\,mm)}{\pi\left(\frac{25\,mm}{2}\right)^2\left(200\,\frac{kN}{mm^2}\right)}$$

$0.15558\,mm = 0.0076394\left(\frac{mm}{kN}\right)F_D$

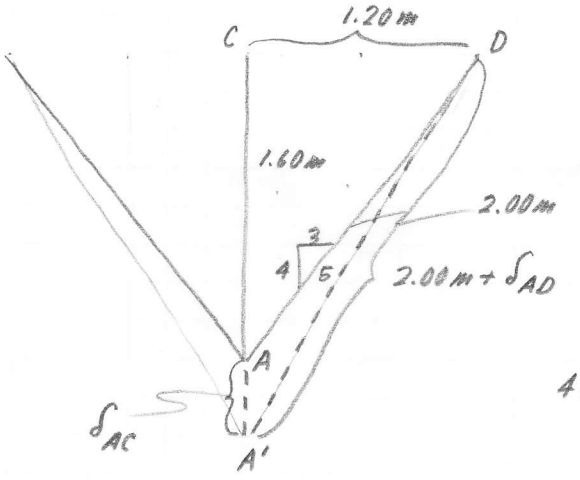
$F_D = 20.37\,kN$

$A_x = 200\,kN - 20.37\,kN$

$A_x = \boxed{179.63\,kN}$

$\boxed{D_x = 20.37\,kN}$

(4-57)



don't need to evaluate equilibrium
just note $F_{AB} = F_{AC} = F_{AD} = F$

compatibility:

$$(L_{A'D})^2 = (L_{A'C})^2 + (1.20\,m)^2$$

$$(2.00\,m + \delta_{AD})^2 = (1.60\,m + \delta_{AC})^2 + (1.20\,m)^2$$

$$4 + 4\delta_{AD} + \delta_{AD}^2 \;(\text{very small} \rightarrow 0) = 2.56 + 3.20\delta_{AC} + \delta_{AC}^2 \;(\rightarrow 0) + 1.44$$

$$4\delta_{AD} = 3.20\delta_{AC}$$

$$\frac{4F(2.00\,m)}{\frac{\pi}{4}(0.002\,m)^2 E} = \frac{3.20F(1.60\,m)}{\frac{\pi}{4}(d_{AC})^2 E}$$

$$d_{AC} = 0.0016\,m$$

or $\boxed{1.60\,mm}$